Huang, X., Steffens, P. R. and Schroder, B., (2002). "Managing New Product Development in the Chinese Steel Industry: An Empirical Investigation," *International Journal of Technology Management*, 24 (5/6), 557-568.

Managing New Product Development in the Chinese Steel Industry: An Empirical Investigation

Xueli Huang*, Paul Steffens** and Bill Schroder***

*Faculty of Business, Edith Cowan University

Churchlands, Western Australia, Australia

Fax: +61 8 9273 8754, E-mail: x.huang@cowan.edu.au

**Technology Management Centre, The University of Queensland,

Brisbane Queensland, Australia, E-mail: P.Steffens@techman.uq.edu.au

***Syme Business School (Peninsula Campus), Monash University

Frankston Victoria, Australia

Fax: +61 3 9904 4645 E-mail: Bill.Schroder@buseco.monash.edu.au

Please address all respondence to:
Dr Xueli (Charles) Huang
Faculty of Business, Edith Cowan University
Churchlands, Western Australia, Australia
Tel: +61 8 9273 8684
Fax: +61 8 9273 8754
E-mail: x.huang@cowan.edu.au

ABSTRACT

This study explores several important aspects of the management of new product development (NPD) in the Chinese steel industry. Specifically it explores NPD success factors, importance of management functions to new product success and measures of new product success from the perspective of the industry's practitioners. Based on a sample of 190 industrial practitioners from 18 Chinese steel companies, the study provides a mixed picture as China makes the transition from a centrally-controlled to market-based economy. On one hand, respondents ranked understanding users' needs as the most important factor influencing the performance of the new products. Further, formulating new product strategy and strengthening market research are perceived as the most important managerial functions in NPD. However, technical performance measures are regarded as more important and are more widely used in industry than market-based or financial measures of success.

Keywords: New product development; innovation; Chinese steel industry; success, successful factors; product management.

Introduction

The last three decades have witnessed considerable research on new product development (NPD), particularly on determinants of new product performance [e. g., 1, 2-7]. As a result, a plethora of factors influencing the outcomes of NPD have been identified, including strategy, product, market, environment, organisation, project team, and management [for more detailed reviews, see 8, 9, 10]. These studies have lead to a number of recommendations for industrial managers to improve their management of NPD activities. However, most of these studies have been undertaken in Western countries, particularly in North America and the UK. Moreover, a recent trend in studying NPD has been focusing on a specific industry [11, 12], because different industry sectors exhibit different patterns of innovation [13] and cross-sectoral studies may reduce effect of the difference between industries on their new product performance and may "lead to attenuated, and possible misleading, conclusions" [14, p. 85].

This paper is concerned with new product management practices in the Chinese steel industry. It investigates several aspects of new product management identified as important in the Western literature in the context of Chinese steel industry. Specifically the study investigates the industry practitioners' perspectives of NPD success factors, importance of management functions to new product success and specific measures of NPD success.

Such a study is warranted for three reasons. First, although the Chinese steel industry is the biggest steel producer in the world, product quality and new products have been of great concern for the government and industry for many years [15, 16]. Second, the Chinese steel industry is facing tough international competition as China is gradually opening its market

to the world. As the steel industry employs about three million people, its survival and growth are crucial to China both economically and socially. Improvement in NPD could enhance the industry's competitive position. The third reason is the uniqueness of China's transitional economy, which is being transformed from a centrally-controlled economy to a more market-oriented economy, which "has important policy and theoretical implications" [17, p. 964]. An understanding of NPD practice could assist both government and industry to formulate innovation policy and strategies during this critical economic reform period.

Research Methods

Questionnaires were developed based on a literature review and in-depth interviews with managers from the steel industry. Based on the literature, particularly the studies of Cooper [2], Griffin and Page [18], and Hart [19], a list of success factors and measures was constructed. Management functions were mainly drawn from the work done by Ali [20] and Branscomb [21]. However, NPD management in the context of China's unique socialist, transitional economy is still largely under-researched. Hence, in-depth interviews were considered necessary to provide good insights into the industry practice of NPD. Unstructured interviews were conducted with 16 managers from six steel companies and 12 government officials. Based on the western literature and interviews measurement scales were developed including 12 measures of success, 12 success factors, and 14 NPD management functions. These items were part of a general study of NPD in the Chinese steel industry.

After questionnaires were pretested, some minor changes in wording and scales were made. The final version of the questionnaire was then distributed to 21 large- and medium-sized

steel companies. Based on the size of these companies, 280 questionnaires were sent by either personal delivery or mail to the project team leaders or senior members of the team. After extensive telephone follow-ups, 190 questionnaires were returned from 18 steel companies [see 22 for the detailed profile of these steel companies and the respondents]. The following results are based on the analyses of these 190 questionnaires.

Results and Discussion

Factors Influencing the Success of New Products

With regard to factors influencing the success of new products, Table 1 lists the 12 variables and their overall ranking by respondents according to their perceived importance for new product success.

Take in Table 1 about here

The two most important perceived determinants of new product success are market-related factors - *understanding users' needs* and the *market size for the new product*. This is a new finding in the Chinese context. The importance of understanding the users' needs to the success of new products has been repeatedly found in previous studies in Western econimies [2-4] and non-Western market economies [e.g., 23, 24, 25]. However, unlike these market economies, the importance of market focus had previously been found absent in previous studies of Chinese state-owned enterprises [26-28].

As economic reform progresses, a more open market mechanism has been steadily introduced into the Chinese economic system. Enterprises have been hard pressed to be

responsible for their business performance [29]. This finding illustrates that the importance of market focus in NPD is gradually being recognised by the steel companies.

Technological variables were ranked as another important dimension to success, particularly, technical information, technological expertise, and production technology. These three items were ranked four, five, and six respectively. This is consistent with the study of NPD in the Chinese state-owned enterprises by Parry and Song [30] who found that there was a strong correlation between technological synergy and new product success. Production technology and facilities have been reported as contributing to success, particularly for industrial new products [31]. However, the important role they play in NPD in the Chinese steel industry cannot be overemphasised, because many companies are still operating on debilitating production equipment. Only about 20 per cent of state-owned enterprises have been equipped with production facilities of the 1980s and 1990s [32].

Variables related to the company's commitment were ranked as being of moderate importance. Two variables were covered in this category: top management emphasis and funds allocated to the projects. The effect of management commitment on product performance is controversial [6, 7, 33]. Our finding here shows that management support is considered important to new product performance, but it trails behind users' needs and technological factors. However, emphasis from the governing state organisations was ranked lowest of all factors listed here.

The analyses above have revealed the pattern of importance of the variables. They follow roughly the ranks of market factors, technological factors, and company's commitment. The pattern is similar to that found by Song and Parry [34] in their study of NPD in China.

Importance of Managerial Functions in NPD

As a starting point, 14 management functions were listed and studied in this research. The first nine functions can be classified as internally oriented, and the last five as externally oriented. Their ranks of perceived importance are shown in Table 2.

Take in Table 2 about here

Internally Orientated Functions

Formulating a company's new product strategy was considered by respondents as the most important managerial function for a firm's NPD. This is another new and significant finding in the Chinese context. The importance of new product strategy has been well acknowledged in a Western context [35, 36]. However, strategic innovation management had been absent in China for most of the state-owned enterprises in the past [37], and largely ignored even today [32]. There are mainly two reasons for this. First, the problem of ownership of these enterprises has not been solved [38], and this encourages industrial managers to emphasise short-term returns; second, the pervasive government intervention exists in managing these enterprises [39-41], and this makes it almost impossible for industrial managers to manage their business strategically. However, the finding here suggests that there is a strong recognition from industrial practitioners that the steel companies should develop strategies in managing their NPD.

Upgrading production facilities comes as the third in rank. Given the nature of NPD in the steel industry, coupled with the existing backward technologies used for most of the state-owned enterprises [32], upgrading production facilities can greatly improve the success of new products to be developed. However, unlike in a market economy, capital investment

in most of the large- and medium-sized state-owned enterprises has been mainly controlled by the Chinese government [32, 41]. This presents a major impediment for the steel companies to upgrade their production technology.

The NPD process was also highly ranked (fourth). As Cooper and Kleinschmidt [3] stressed, better project selection and management of the process are two crucial aspects to improve the effectiveness and efficiency of NPD. In the Chinese steel industry, there was much room for improving the NPD process, such as marketing function, evaluation procedure, and inter-departmental coordination, as revealed by our in-depth interviews with industrial managers and government officials.

Externally Orientated Functions

There are five externally related functions listed in the questionnaire. Strengthening marketing research, and communication and cooperation between the producers and users are both highly ranked as second and fifth respectively.

Market research comes second in terms of perceived importance. Poor market research has long been identified as a cause for failure [42]. Moreover, understanding user's needs has been repeatedly found as one crucial factor in new product success [2, 6, 43]. Both of these require a strong marketing function within a company [5]. However, market research function at present has been very weak at the company level. Only few big companies have set up a department for market research, but the allocation of resources to the department is very small [44]. Thus, it could be very difficult to identify the market needs for new products, which are considered important to improve the companies' economic performance.

The importance of communication and cooperation with users is consistent with western literature. Communication with the users is a very effective way to promote understanding of user's needs, and so improve new product performance [45]. This may be the major reason to explain why communication is ranked highly by the respondents. The second reason is that good communication might be considered as a substitute for the poor market research function within the steel company. Through communication with users, information about the potential market size could be obtained.

Cooperation with users has long been recognised as a strategy to improve new product performance [46-49]. The users, particularly in the industrial market, usually have complementary resources, in terms of the expertise and facilities, to conduct some development activities, such as market test. For most of the new products developed in the Chinese steel industry, field trial-use of the new product is the most critical evaluation of technical performance. Thus, cooperation with users is required for successful NPD.

Compared with cooperation with users, cooperation with external R&D institutes and universities is ranked low (13 out of 14). This is unexpected. Globally, the importance of cooperation between producers and universities (or R&D) has been stressed over recent years [50]. Why did not the Chinese industrial practitioners like it? The results of past cooperative new product projects provide valuable insights on this question. Cooperative new product projects have been encouraged by the government through funding allocation. Some universities have taken advantage of this to get research funds from the government. Thus, the universities usually initiated proposals for cooperative projects with industrial producers. After the projects were approved, funds were usually allocated to the

universities, and they may have had nothing to do with the producers except for a signature in the project appraisal documents. As long as the producers' motivation and trust for the cooperative projects were lost, their perceived importance would be lowered.

Measures of Success Used by the Chinese Steel Industry

Having looked at those factors considered important for the success and management of NPD in the Chinese steel industry, we now turn our attention to the measurement of NPD success. The 12 measures of success used in the questionnaire are listed in Table 3. Three factors are identified using an exploratory factor analysis. They explain 58.1 per cent of the variance are similar to those identified by Griffin and Page [18] as financial measures, product level measures, and customer acceptance.

Take in Table 3 about here

The last item in the factor of financial performance, the attainment of awards, requires some explanation. Awards have been a very important criterion in the Chinese context. Steel companies had previously been treated by the government as workshops, rather than autonomous organisations. These awards have served as the only incentives for NPD.

The usage and importance of these 12 measures are shown in Table 4. It is clear that there are a variety of multidimensional measures of success used in the Chinese steel industry. All the measures listed in the questionnaire had been used in the steel industry, ranging from 63.5 per cent to 43.6 per cent of new product projects under study. This result is in line with those reported by previous research [3, 18]. However, most of the firms reported

that they used six to eight measures for success, which is larger than the average of 3.7 measures reported by Griffin and Page [18, p. 298].

Take in Table 4 about here

Overall, measures of success relating to the technical dimension are clearly considered the most important and widely used. This is not surprising, because new steel products are usually used as important input into other key industries, such as the defence and aviation industries. However, this is not consistent with our findings previously discussed that market related factors are the most important factor for NPD success.

Market-related measures of success, such as users acceptance and satisfaction, have gained some prominence in evaluating new product success. However, the respondents ranked a clear second behind technical considerations. Traditionally, new product projects in the Chinese steel industry had been commanded by the government agencies and allocated to the users who needed them. From a producer's point of view, a new product would be produced as long as it conformed to technical specifications. Hence, users' acceptance and satisfaction were less important. However, as reform progresses, the managers in state-owned enterprises have been delegated to take more responsibilities for their business, such as NPD. Therefore, the importance of the market has increased in evaluating new product success.

The financial measures of success were all rated low in importance. This finding is certainly in contrast to Western firms and is not entirely congruent with some of the above findings. As already noted, the highly perceived importance of a market orientation for

NPD and developing a NPD strategy indicate a shift of management to recognise the transition to a market driven economy. However, the lack of importance of financial measures of success clearly indicates that this transition is yet to fully take effect. There are several reasons for this.

First, new products usually account only for a small proportion of sales in the Chinese steel companies. Of the increase of gross output value of state-owned enterprises, only about one quarter was estimated from the technological factors during 1952-1982, according to a recent survey [32, p. 242]. This was much lower compared with 50 to 70 per cent in developed countries in the same period. Thus, the profits of new products were not to be of primary importance in the Chinese steel industry. Second, because new product projects were often commanded by the State, which are often 'mission-oriented' [51, p. 146], the producer had no alternative but to undertake the project, even if it had small sales and was unprofitable.

The current management procedure of NPD also makes a substantial contribution to this. One of the distinguishing features of the China's innovation system is the evaluation procedure. In particular, a formal appraisal procedure is used to assess the innovation values, mainly technical level [51, p. 126]. This may be the third, and more substantial underlying reason to explain the low ranks for the financial criteria. It also explained why technological criteria were ranked so high in the responses.

Finally, we also note that the first two parts of the study (importance factors for NPD success and importance of managerial functions) relate to normative perceptions of managers. That is, they pose the question "what should be done?" In contrast, the last part

of the study (use and importance of measures of success) relate to positive perceptions of mangers. That is, they ask the question “what is done?” Therefore, it is also possible that the contrasting findings therefore reflect the difference between what managers recognise as the future path to compete in a market-based economy and the current reality of management practice.

Conclusions and implications

This paper explores the current state of NPD management within the Chinese steel industry. As China makes the transition from a centrally-controlled economy to a market-based economy, the study also paints a picture of management in a transitional state. On one hand, market-based factors are ranked ahead of technical and organisational factors in terms of importance for NPD success. Further, formulating new product strategy and strengthening market research were identified as the most important internally orientated and externally orientated managerial functions respectively. However, the importance and use of technically-related measures of NPD success rated above both market-related and financially-related measures. It is possible that this reflects the difference between what managers recognise as the correct path to compete in a market-based economy and the current reality of management practice.

The findings in this research have several implications for both managers in the Chinese steel industry and Chinese government officials. As the centrally-controlled economic system is gradually moving to a market economic system, market forces would play a more and more important role in determining success of new products. Therefore, more attention should be paid by the steel companies to achieving a balance between the technical

performance, user's satisfaction and profits when measuring the success of NPD. Further, for the industrial managers, more effort could be devoted to formulating new product strategy. As China is trying to compete in the global market, it is urgent for the Chinese steel industry to adopt strategic management. Thus, the formation and implementation of a company's new product strategy are one of the most important issues facing the Chinese industry. Finally, the market research function needs to be enhanced within the steel companies. Both understanding of user' needs and quality of executing the NPDP demand well-performed market research.

For government officials, the findings here suggest that several areas need more attention. The Chinese government could provide incentives to encourage the steel companies to pursue a strategic approach in managing their businesses while more and more responsibilities are delegated to them. This has been called for strongly by the industrial managers [22]. Second, the Chinese government could provide relevant market information to the producers and users of new products, because of the weak market research function currently in the steel companies. However, emphasis may be placed to help the steel companies to develop their own market research capacity in the long run. Finally, how to maintain a proper control for investment to upgrade production facilities is another important issue to be tackled by the Chinese government.

The limitations of this research should be explicitly recognised and taken into consideration when interpreting the findings. This is one of the first studies to investigate NPD in the Chinese steel industry and, as such, provides an incomplete picture. First, the study is based on the perceptions of mangers and suffers the normal limitations of response bias

associated with in surveys of this type. Also, the sample was restricted to managers working in R&D divisions. Their views may not be representative of the whole company. Finally, there is a concern with the representativeness of the sample unit. Although the sample of steel companies included a majority of the key players in NPD, a survey of all the steel companies, or even all the active players, would be more desirable.

The current study also suggests a number of promising avenues for future research. A longitudinal study of management practices would provide a very valuable insight into changes in response to the dramatic environmental changes. Cross sectional studies at a NPD project level, similar to those conducted in market-based economies, could also provide supporting evidence for those factors considered by management as important for NPD success.

References

1. Rothwell, R., *et al.*, *SAPPHO Updated -- Project SAPPHO Phases II.* Research Policy, 1974. **3**(3): p. 258-291.
2. Cooper, R.G., *Identifying Industrial New Product Success: Project NewProd.* Industrial Marketing Management, 1979. **8**(2): p. 124-135.
3. Cooper, R.G. and E.J. Kleinschmidt, *Success Factors in Product Innovation.* Industrial Marketing Management, 1987a. **16**: p. 215-223.
4. Cooper, R.G. and E.J. Kleinschmidt, *New Products: What Separates Winners from Losers.* Journal of Product Innovation Management, 1987b. **4**(3): p. 169-184.
5. Hopkins, D.S., *New Product Winners and Losers*, . 1980, Conference Board.
6. Maidique, M.A. and B.J. Zirger, *A Study of Success and Failure in Product Innovation: The Case of the U.S. Electronics Industry.* IEEE Transactions on Engineering Management, 1984(4): p. 192-203.
7. Rubentein, A.H., *et al.*, *Factors Influencing Success at the Project Level.* Research Management, 1976(May): p. 15-20.
8. Craig, A. and S. Hart, *Where to Now in New Product Development Research?* European Journal of Marketing, 1992. **26**(11): p. 1-49.
9. Montoya-Weiss, M.M. and R. Calantone, *Determinants of New Product Performance: A Review and Meta-Analysis.* Journal of Product and Innovation Management, 1994. **11**(November): p. 397-417.

10. Brown, S.L. and K. Eisenhardt, *Product Development: Past research, Present findings, and Future Directions.* Academy of Management Review, 1995. **20**(2): p. 343-378.

11. Abratt, R. and A.v.A. Lombard, *Determinants of Product Innovation in Speciality Chemical Companies.* Industrial Marketing Management, 1993. **22**: p. 169-175.

12. Cooper, R.G. and E.J. Kleinschmidt, *Major New Products: What Distinguishes the Winners in the Chemical Industry?* Journal of Product Innovation Management, 1993a. **10**(2): p. 90-111.

13. Pavitt, K., *Patterns of Technical Change: Taxonomy and a Theory.* Research Policy, 1984(6): p. 343-373.

14. Cooper, R.G. and E.J. Kleinschmidt, *New Product Success in the Chemical Industry.* Industrial Marketing Management, 1993b. **22**(2).

15. The Editorial Board of the Yearbook of the Iron and Steel Industry of China, The Yearbook of the Iron and Steel Industry of China. 1995.

16. The Editorial Board of the Yearbook of the Iron and Steel Industry of China, The Yearbook of the Iron and Steel Industry of China. 1996.

17. Walder, A.G., *China's Transitional Economy: Interpreting its Significance.* The China Quarterly, 1995(December): p. 963-979.

18. Griffin, A. and A.L. Page, *An Interim Report on Measuring Product Development Success and Failure.* Journal of Product Innovation Management, 1993. **10**: p. 291-308.

19. Hart, S., *Dimensions of Success in New Product Development: An Exploratory Investigation.* Journal of Marketing Management, 1993(9): p. 23-41.

20. Ali, A., Malaysia's Industrialization: The Quest for Technology. 1992, Singapore: Oxford University Press.

21. Branscomb, L.M., *The National Technology Policy Debate*, in Empowering Technology: Implementing a U.S. Strategy, L.M. Branscomb, Editor. 1993, The MIT Press: Cambridge, Massachusetts, and London, England. p. 1-35.

22. Huang, X., B. Schroder, and P. Steffens, *The Chinese Steel Industry in Transition: Industry Perspective on Innovation Policy.* R&D Management, 1999. **29**(1): p. 1-9.

23. Rothwell, R., *The 'Hungarian SAPPHO': Some Comments and Comparison.* Research Policy, 1974(3): p. 30-38.

24. Utterback, J.M., *et al.*, *The Process of Innovation in Five Industries in Europe and Japan.* IEEE Transactions in Engineering Management, 1976(Feb.): p. 3-9.

25. Edgett, S., D. Shipley, and G. Forbes, *Japanese and British Companies Compared: Contributing Factors to Success and Failure in NPD.* Journal of Product Innovation Management, 1992. **9**(1): p. 3-10.

26. Simon, D.F. and D. Rehn, Technological Innovation in China: The Case of the Shanghai Semiconductor Industry. 1988, Cambridge MA: Ballinger Publishing Company.

27. Hay, D., *et al.*, Economic Reform and State-Owned Enterprises in China, 1979-1987. 1994, New York: Clarendon Press Oxford.

28. Huang, X. *Research on New Product Development Process: Where to Go Next?* in *1994 Australian Marketing Conference*. 1994. Adelaide.

29. Yeh, K.-C., *Economic Reform: An Overview*, in China's Economic Reform, W. Galenson, Editor. 1993, The 1990 Institute: San Francisco. p. 11-32.

30. Parry, M.E. and X.M. Song, *Identifying New product Successes in China.* Journal of Product Innovation Management, 1994. **11**: p. 15-30.

31. Booz Allen & Hamilton, New Products Development in the 1980's. 1982: Booz Allen & Hamilton Inc.

32. Ding, J., *Technical Transformation and Renovation in PRC Industry,* in The Emerging Technological Trajectory of the Pacific Rim, D.F. Simon, Editor. 1995, M. E. Sharpe, Inc.: Armonk, New york, London, England. p. 239-255.

33. Langrish, J., *et al.*, Wealth from Knowledge. 1972, London: Macmillan.

34. Song, X.M. and M.E. Parry, *The Dimension of Industrial New Product Success and Failure in State Enterprises in the People's Republic of China.* Journal of Product Innovation Management, 1994. **11**: p. 105-118.

35. Cooper, R.G., *Overall Corporate Strategies for New Product Programs.* Industrial Marketing Management, 1985. **14**: p. 179-193.

36. Pavitt, K., *What We Know about the Strategic Management of Technology.* California Management Review, 1990: p. 17-26.

37. Fan, Q., *State-owned Enterprise Reform in China: Incentives and Environment,* in China's Economic Reforms: The costs and Benefits of Incrementalism, Q. Fan and P. Nolan, Editors. 1994, THE MACMILLAN PRESS LTD: New York. p. 137-156.

38. Wood, A., *China's Economic System: A Brief Description, with Some Suggestions for Further Reform,* in China's Economic Reforms: The Costs and Benefits of Incrementalism, Q. Fan and P. Nolan, Editors. 1994, The MacMillan Press Ltd: New York. p. 21-45.

39. Koo, A.Y.C., E.H.-M. Li, and Z. Peng, *State-Owned Enterprise in Transition*, in China's Economic Reform, W. Galenson, Editor. 1993, The 1990 Institute: San Francisco. p. 33-80.

40. Wang, H., *Technology Management in a Dual World.* International Journal of Technology Management, 1993. **8**(1/2): p. 108-120.

41. Wang, H., *Technology Management and Enterprise Management, and a Case Study in China.* International Journal of Technology Management, 1994. **9**(5/6/7): p. 564-574.

42. Cochran, B. and G.C. Thompson, *Why New Products Fail*, . 1964, The Conference Board.

43. SPRU, Success and Failure in Industrial Innovation. 1972, London: Centre for the Study of Industrial Innovation.

44. Huang, X., *Marketing Research in the Chinese Steel Enterprises.* Management for Metallurgical Industries, 1992(8).

45. Ancona, D.G. and D.F. Caldwell, *Demography and Design: Predictors of New Product Team Performance.* Organisation Science, 1992. **3**: p. 321-341.

46. von Hippel, E., *The Dominant Role of Users in the Scientific Instrument Innovation Process.* Research Policy, 1976. **5**(3): p. 212-239.

47. von Hippel, E., *The User's Role in Industrial Innovation*, in Management of Research and Innovation, B.V. Dean and J.L. Goldhar, Editors. 1980, North-Holland Publishing Company. p. 53-65.

48. von Hippel, E., The Sources of Innovation. 1988: Oxford University Press.

49. Shaw, B., *The Role of the Interaction Between the User and the Manufacturer in Medical Equipment Innovation.* R & D Management, 1985. **15**(4): p. 283-292.

50. Geisler, E., *Editorial: On the Importance of University-Industry-Government Cooperation: A Global Perspective.* International Journal of Technology Management, 1993. **8**(6/7/8): p. 435-8.

51. Conroy, R., Technological Change in China. 1992, Paris: OECD.

Table 1 Factors Influencing the Success of New Products

Criterion	Mean	Stdev**	Rank
Understanding users' needs	1.51	0.96	1
Market size for the new product	1.87	1.16	2
Hard work from the new product team	1.93	1.38	3
Knowledge of technical information of the new product	2.02	0.96	4
Knowledge of the technological aspects of the new product	2.15	1.18	5
Good production technology	2.2	1.2	6
Company’s top management support	2.23	1.47	7
Enough funds for the new product project	2.41	1.51	8
Degree of market competition	2.47	1.69	9
Good laboratory facilities	2.48	1.44	10
Good testing facilities	2.59	1.4	11
Emphasis from the ministerial leaders on the new product project	3.15	2.04	12

Note: 7-point scales, with 1 denoting the most important, and 7 the least important.

**: Standard deviation.

Table 2 The Importance of Mangerial Functions for NPD

Managerial Function	Mean*	Stdev**	Ran
Internally Orientated Functions			
Formulate new product strategy of the company	1.67	1.07	1
More investment to upgrade production technology	2.08	1.24	3
Improve company's NPD process	2.1	1.3	4
Promotion of the NP developed	2.22	1.26	6
More emphasis on R&D	2.23	1.18	7
Strengthen the coordination between the departments within company	2.44	1.37	9
Training of R&D personnel	2.57	1.46	10
Allocate more funds to NPD	2.68	1.47	12
Provide more incentives to the people involved in NPD	2.81	1.62	14
External Orientated Functions			
Strengthen market research function for NPD	1.71	0.99	2
Encourage communication and cooperation between producers and users	2.21	1.30	5
Strive to get more new product projects from users	2.29	1.32	8
Strive to get more projects from the government	2.58	1.63	11
Strengthen the cooperation with external R&D institutes and universities	2.74	1.53	13

*: 7-point scales, with 1 denoting to the most important, and 7 to the least important.

**: Standard deviation.

Table 3 Factors Underlying Measures of New Product Success

Factor and Variable (% variance explained)	**Loading**
Financial dimension (35.6)	
Profits of new products	.80
Sales of new products	.79
Success rate in the production of new products	.68
Attainment of the relevant award	.60
Technical dimension (13.8)	
Fulfilment of the technical specification specified on the new product contract.	.68
Reliability of quality of new products	.81
Technical advancement level of new products	.60
Production reliability of new products	.68
Market dimension (8.7)	
User's satisfaction of new products	.80
Product meets user’s acceptance standards	.70
Competitiveness of new products	.64
Potential diffusion of new products to other manufacturer	.44

Table 4 The Usage and Importance of Measure of Success in the Chinese Steel Industry

Criterion	Used now			Importance *		
	No.	(%)	Rank	Mean	Stdev**	Rank
Technical dimension						
Fulfilment of the technical specification specified on the new products contract.	115	63.5	1	1.9	1.48	1
Reliability of quality of new products	108	59.7	5	2.09	1.33	2
Technical advancement level of new products	113	62.4	2	2.22	1.33	4
Production reliability of new products	96	53.0	8	2.24	1.38	5
Market dimension						
User's satisfaction of new products	109	60.2	4	2.13	1.48	3
Product meets user's acceptance standards	79	43.6	11	2.28	1.40	6
Competitiveness of new products	105	58.0	6	2.33	1.38	7
Potential diffusion of new products to other manufacturer	100	55.2	7	2.49	1.55	8
Financial dimension						
Profits of new products	110	60.8	3	2.55	1.66	9
Sales of new products	93	51.4	9	2.75	1.63	10
Success rate in the production of new products	84	46.4	10	2.76	1.57	11
Attainment of the relevant award	67	37.2	12	3.53	2.06	12

*: 7-point scales, with 1 denoting to the most important, and 7 to the least important.

**: Standard deviation.

Biographical Notes

Dr Xueli Huang is a Research Fellow in Faculty of Business at Edith Cowan University, Australia. He has received his master and bachelor degrees (Engineering) from Wuhan Yejin University of Science and Technology in PRC. He held a position of Deputy Director of China-Australia Iron and Steel Industry Training Centre from 1990-1995. His PhD (Marketing) is from Monash University, Australia. His research areas include Innovation Management, International Business and Marketing on the Internet. His work has been published in *R&D Management*, *Journal of Advertising Research*, and *Advances in International Marketing*.

Dr Paul Steffens is a Senior Lecturer in the Technology Management Centre, The University of Queensland. His PhD is from The University of Queensland. His research interests include R&D Management, New Product Development and Diffusion of Innovations. He has published widely, including publications in *R&D Management*, *Marketing Letters* and the *Journal of Forecasting*.

Dr Bill Schroder is a Professor of Marketing at Monash University. He is currently the Head of Syme Business School. His research interests include Agribusiness Marketing, Strategic Marketing, and Relationship Marketing. His work has appeared in many publications, including *Industrial Marketing Management*, *R&D Management* and *Agribusiness*.